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Phytopharmaceuticals in Mongolia: Past, Present, and Future

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Phytopharmaceuticals in Mongolia; past present and future

D. Gunbilig & U. Rentsendorj

Abstract

Over the last two decades, the consumption of medicinal plants has increased in Mongolia. Once banned by the post-revolutionary government, it is now valued by the practitioners of orthodox medicine, government as well as by the society. Yet the scientific community has to give this major and crucial component of traditional Mongolian medicine the attention it deserves, scientific knowledge about biologically active principles within medicinal plants remain poorly unknown. At the same time, due to over exploitation of plants many species are becoming extinct together with invaluable traditional knowledge being lost. For these reasons, there is a certain urgency to increase efforts in the area of medicinal plant research e.g. rapid chemical and biological screening of plant and drug extract as well as evaluation of biologically active principles contain. Further, focus area in research area behaviour of medicinal plants concerning environmental conditions. New attempts were made to manipulate secondary metabolism. Legislation of plant use as a drug, use/trade of endangered plant species as a medicine are of highest interest. Tendency of research, development of analytical technology and achievements in the past, present and future are discussed.

Key words: phytopharmaceuticals, traditional medicine, biologically active compounds, plants, insects

Introduction

Traditional medicines mostly of Asian origin have become very popular in the West during the past decades due to various factors such as growing tourism, publicity and the increasing demand of Western patients for alternative or complementary medicine. Yet the scientific community has to give traditional Mongolian medicine the attention it deserves, scientific knowledge about "traditional pharmaceuticals" remain poorly unknown even it has been used broadly by Mongolians who's number reach over nine million to date.

Once banned by the post-revolutionary government, traditional Mongolian medicine now valued again by the practitioners of orthodox medicine, government as well as by the society. Starting in late 1950s efforts were officially initiated by the government to initiate research in traditionally used medicinal drugs and traditional medical theories. Again after the political changes in 1990s, all restrictions on practicing traditional medicine in Mongolia were lifted. Traditional medicine had again become officially recognized as national heritage and vast numbers of research organizations contribute in research of traditional medicine at present.

Research areas include botany, natural products chemistry, biochemistry, molecular biology, pharmaceutical chemistry and chemical ecology. IT, linguistics, Tibetology, ethnography *etc.* are the research area of utmost necessity too.

Natural product chemistry and chemical ecology

The medical preparations, a complex mixtures of a varying number of ingredients, mainly from plants and insects but also minerals and animal drugs have been used in traditional Mongolian medicine since ancient time (fig. 1).



Fig. 1: Illustrations of some insects used in traditional medicine in an ancient medical book/sutra JAMBALDORJ (XVIII century).

The medical application of specific plants for long periods, e.g. in traditional medicine, indicate the presence of biologically active substances in plants.

Rich numbers of secondary metabolites in plant are operative in response to herbivore attack, pathogen invasion and environmental stresses etc. These are mostly small molecules with higher biological activity, which are not directly involved, in the basic photosynthetic and metabolic activities.

Chemical studies of several well-known medicinal plants e.g. *Achillea* species were performed and new compounds could be isolated (GLASL et al. 2001) and their 2D and 3D chemical structures (fig. 2) could be elucidated (GLASL et al. 2001).

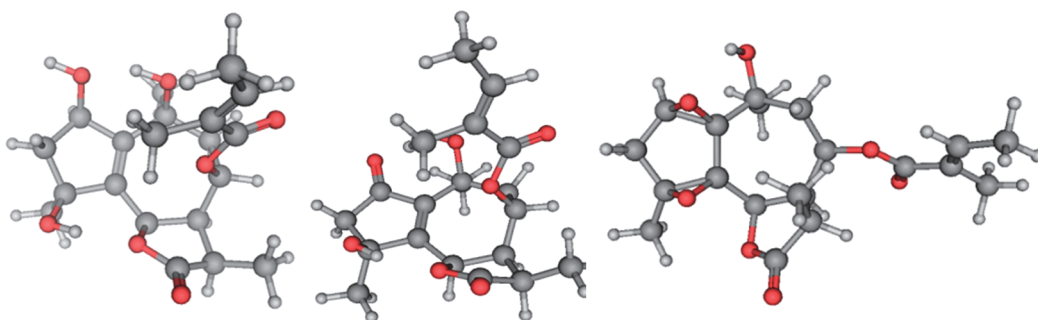


Fig. 2: Highly hydroxylated new guaianolides isolated from *Achillea asiatica* (GLASL et al. 2001).

Results showed presence of highly hydroxylated guaianolides with clearly demonstrated anti-inflammatory activity. This explains the use of *Achillea* plants in traditional medicine, healing of wounds, gastric and intestinal inflammation etc.

Other investigations focused on traditional Mongolian medicinal plant for the treatment of hepatobiliary disorders (GLASL et al. 2007) and research of insects (GUNBILIG & BOLAND 2009) used to treat a great variety of locally diagnosed gastrointestinal ailments.

On the other hand, insects, due to their defense and communication chemicals - e.g. pheromones, defensive sprays, venoms and toxins, which were sequestered from plants or prey and later concentrated or transformed for their own use, are of great importance in traditional medicine (GUNBILIG & BOLAND 2009).

Therefore, an understanding of chemical nature, interactions between organisms and their environment that are mediated by naturally occurring chemicals is of great importance to understand the principles of traditional Mongolian medicine. In the framework of joint research between German and Mongolian scientists, a core research laboratory for chemical ecology supported by the MPG was established in 2011.

Transliteration and transfiguration of traditional medical knowledge

The Mongolian medical system integrated important aspects of other oriental medicines such as Ayurveda and Tibetan medicine. Medical disputations and the exchange of scholars between Mongolia and Tibet since the 13th century stimulated the development of the medical system on both sides. Medical practitioners were called from Tibet to Mongolia as court physicians, and independent medical schools developed in Mongolia. Numerous *materia medica* contribute Mongolian traditional medicine and variety of ancient medical books about medicinal plants and their use in medicine by local authors as well as translations of renowned Ayurvedic medical sutra exist (JAMBALDORJ XVIIIth century).

The MPG-MAS Competitive center for digitalization of cultural heritage (<http://www.mocho.ac.mn>) was established recently in Ulaanbaatar in order to document and gather those invaluable information and knowledge hidden in ancient Mongolian and Tibetan medical textbooks. A team of scientists from the field of Tibetology, linguistics, archaeology, ethnography and chemistry together with IT specialists and librarian is working with up-to-date modern techniques available.

Biological diversity used in traditional medicinal drugs

The number of species registered in Mongolian Flora is low compared with tropical countries but the unique eco-regions found in the country coupled with lower human activity have resulted in an important assemblage of fauna and flora.

According to GRUBOV V.I. (2001), totally 670 genera with 2850 plant species are registered in Mongolia.

Due to comprehensive biodiversity research, the number of species in Mongolia and information on their distribution has grown in the last decade; the number of vascular plant species increased by about 130 species between 1998 and 2008, whereas approximately a one third of them (BOLDSAIKHAN 2004) recorded as medicinal plants and this number tends to increase.

Trading of traditional medicines

Market importance of traditional herbal medicines represents an important share of the Mongolian pharmaceutical market. According to a research survey (ZINA et al. 2007), 36 of traditional medicine manufactures are operative officially, which produce 16 % of the total pharmaceuticals in the market, reaching 7.8 tons of traditional medicinal products (BOLDSAIKHAN 2004). A WHO representative study carried out among the population in 2007 confirmed that a 23.5% of people use such medicines regularly (ZINA et al. 2007). The total turnover of traditional herbal medicines in pharmacies was 149.4 million Mongolian tugrik (including value-added taxes) in 2007 at retail price level.

Legal status

In terms of legal status, traditional herbal medicines and their material are fully considered as medicines in Mongolia. This legal position came into force in 1998, which set new standards for

the granting of marketing authorization. Under this new regulation, proof of quality, safety, and efficacy became an essential pre-condition for the registration und further use of traditional herbal medicines. To meet the requirements the authorities were obliged to carry out a complex review. An interdisciplinary commission of experts reviews the herbal products. All data available (data from chemical, pharmacological and clinical research, data from scientific publications etc.) to be collected and submitted to the commission.

Criteria for registration and further monitoring and standardization are set out by national guidelines for traditional medicinal materials and formulas established in 2003 such as the guidelines for modern instrumental analytical test requirements. Because there is a growing interest to use traditional herbal medicine, new model guidelines of inspection are going to be developed similarly to the international guidelines, especially to German Commission E, a scientific advisory board of the "*Bundesinstitut für Arzneimittel und Medizinprodukte*" which gives scientific expertise for the approval of substances and products previously used in traditional, folk and herbal medicine.

Nevertheless, further improvement of standardization and quality inspection of traditional medicines is required to ensure a high quality (ZINA et al.2007, BOLDSAIKHAN 2004).

Conclusion

Taking into the consideration of all above, a joint research laboratory for chemical ecology between Max Planck Society and Mongolian Academy of Sciences was established in 2010. Defense mechanisms of plants and insects and their interaction on various levels will be studied using modern analytical and molecular methods in order to identify signals from herbivores and predatory organisms and initiated events related to stress recognition by the plant e.g. interactions in the network of plant secondary metabolites.

However, the main goal of the research laboratory will remain untargeted metabolomics of the plants bioactive compounds by means of bio-assay-guided fractionation, further isolation and identification/elucidation during environmental interaction. The plants of our study belong to families that are well-known sources for medicinal plants, but the selected species are in general, scarcely investigated and only few studies exist about their efficacy.

Research in prae- and postdoc level as well as academic exchange of scholars will take place. Real time sharing of facilities and data for the joint research is foreseen. Expected results and data's having been achieved to date will provide a scientific explanation about traditionally used plants as medicine.

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